NEMO

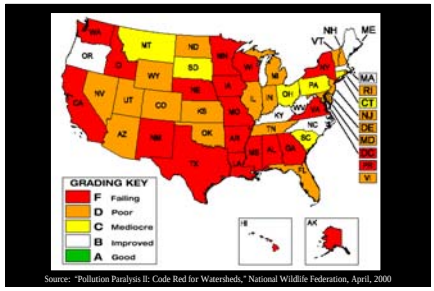
Nonpoint Education for Municipal Officials

Linking Land Use to Water Quality

What We Are Going to Discuss...

- Introduction
  - What is Nonpoint Source Pollution?
- Future Conditions
  - Population trends
  - Build-out Analysis
- Impacts of Development
  - Contaminants of concern
- Existing Conditions
  - Impervious Analysis
  - Gilmanton Examples
- Strategies
  - Natural Resource Planning
  - Green Site Design
  - BMP's
- Conclusions

The "Old Era" of Water Pollution



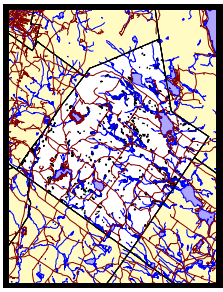
Source: "Pollution Paralysis II: Code Red for Watersheds," National Wildlife Federation, April, 2000

Major Sources of Non-point Source Pollution

- Lawns and Golf Courses
- Car Exhaust and other Air Pollution
- Man-made Waterways
- Road and Building Construction Sites
- Logging
- Roads and Parking Lots
- Agricultural Fields and Grazing Land

Local Land Use Decision Making: *Educational Challenges*

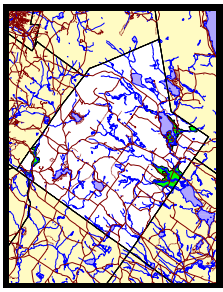
- Legal Mandates
- Full Plate
- High Turnover
- Complexity of Environmental Issues
- Tracking of Cumulative Impacts



WETLANDS

Wetland Soils

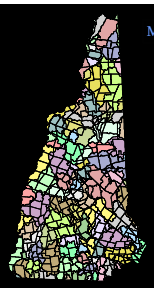
Source: National Wetlands Inventory, U.S. Fish & Wildlife Service



WATER RESOURCES

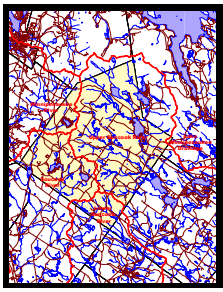
- Aquifers
- Surface Water

Source: USGS Open-File Report WRI 47-75, 1975

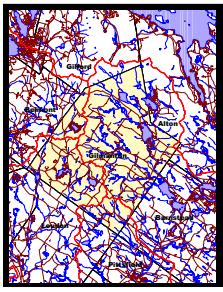


Major Watersheds in New Hampshire

A watershed is an area in which all drainage flow to a common outlet.



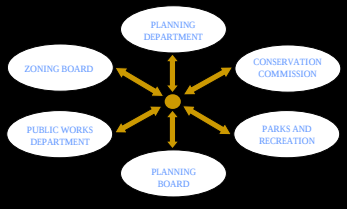
- Upper Suncook River (61.2%)
- Soucook River (24.3%)
- Lower Suncook River (7.4%)
- Winnipesaukee River (6.9%)
- Lake Winnipesaukee Drainage (0.2%)



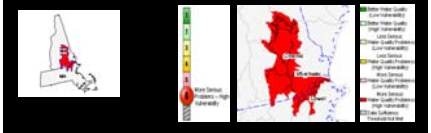
Watersheds Cross Boundaries: It takes communication!

- inter-regional cooperation
- inter-town cooperation

Watersheds Need Town-Wide Cooperation



Watersheds Need Region-Wide Cooperation

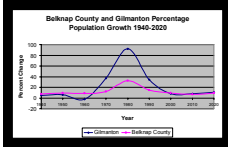


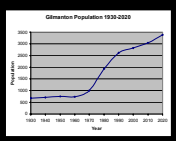
Merimack Drainage Basin

Index of Watershed Indicators (IWI) U.S. Environmental Protection Agency

The Effects of Urbanization

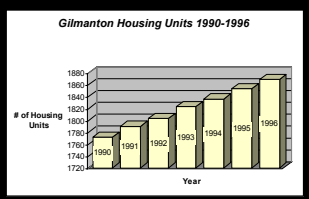
POPULATION AND HOUSING ON THE RISE



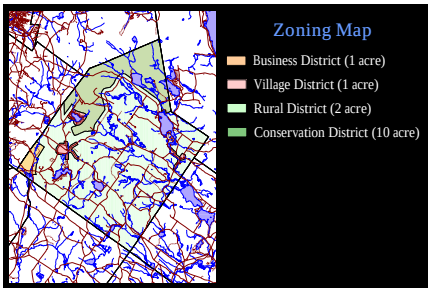


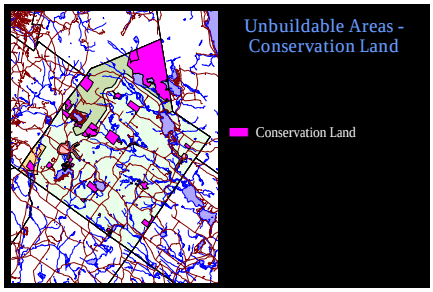
Source: US Census and NH Office of State Planning (2000-2020 Population Estimates and Projections)

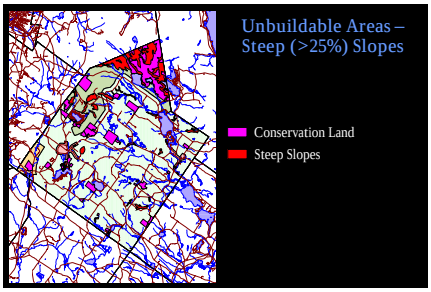
POPULATION AND HOUSING ON THE RISE

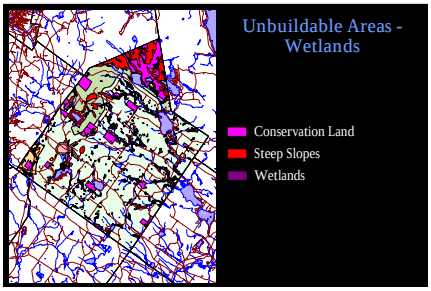


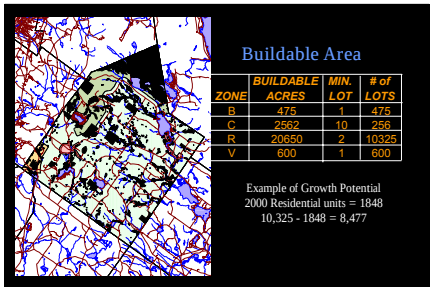
Source: NH Office of State Planning

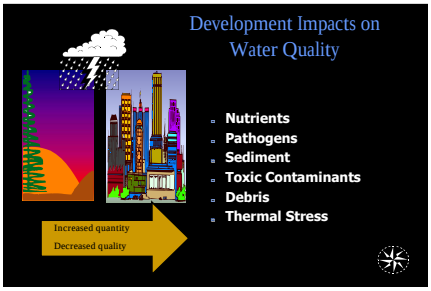

Zoning Map
Business District (1 acre)
Village District (1 acre)
Rural District (2 acre)
Conservation District (10 acre)

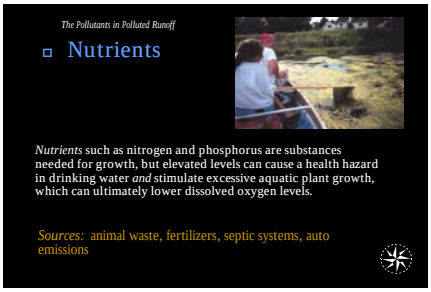

Unbuildable Areas - Conservation Land
Conservation Land


Unbuildable Areas – Steep (>25%) Slopes
Conservation Land
Steep Slopes


Unbuildable Areas - Wetlands
Conservation Land
Steep Slopes
Wetlands


Buildable Area
ZONE | BUILDABLE ACRES | MIN. LOT | # of LOTS
B | 475 | 1 | 475
C | 2562 | 10 | 256
R | 20650 | 2 | 10325
V | 600 | 1 | 600
Example of Growth Potential
2000 Residential units = 1848
10,325 - 1848 = 8,477


Development Impacts on Water Quality
Increased quantity
Decreased quality
Nutrients
Pathogens
Sediment
Toxic Contaminants
Debris
Thermal Stress


The Pollutants in Polluted Runoff
Nutrients
Nutrients such as nitrogen and phosphorus are substances needed for growth, but elevated levels can cause a health hazard in drinking water and stimulate excessive aquatic plant growth, which can ultimately lower dissolved oxygen levels.
Sources: animal waste, fertilizers, septic systems, auto emissions


The Pollutants in Polluted Runoff
Gilmanton Corners
Pathogens
Pathogens are disease-causing bacteria and viruses associated with the presence of fecal matter that cause swimming restrictions and unsanitary conditions.
Sources: failing septic systems and animal waste


The Pollutants in Polluted Runoff
Area Construction
Sediment
Sediment is eroded soil or sand which smothers aquatic habitat, carries pollutants, and reduces water clarity.
Sources: road sand, construction sites, agricultural fields, disturbed areas

The Pollutants in Polluted Runoff

Toxic Contaminants

Currier Hill Road Town Shed

Toxic contaminants are compounds like heavy metals and pesticides that can threaten the health of both aquatic and human life, and are often resistant to breakdown.

Sources: industrial, commercial, household and agricultural chemicals; auto emissions

The Pollutants in Polluted Runoff

Debris

Crystal Lake Boat Launch

Debris includes plastics and other trash that threaten aquatic life and detract from recreational and aesthetic values.

Sources: illegal dumping, street litter, beach litter, boating waste

The Pollutants in Polluted Runoff

Thermal Stress

Thermal stress is an elevation in water temperature that can harm native species while helping non-native species to spread.

Sources: runoff from heat-absorbing impervious surfaces, removal of streamside vegetation, shallow water impoundment, decreased base flow

The Built Environment Effects the Natural Environment.

INTENSITY OF LAND USE

WATER QUALITY PROBLEMS

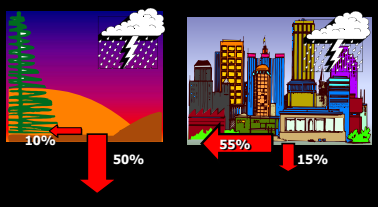
AMOUNT OF IMPERVIOUS SURFACE

Impervious Surfaces?

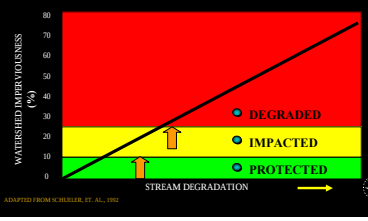
Materials like cement, asphalt, roofing, and compacted soil that prevent percolation of runoff into the ground.

Gilmanton School on Route 106

Development Impacts on the Water Cycle



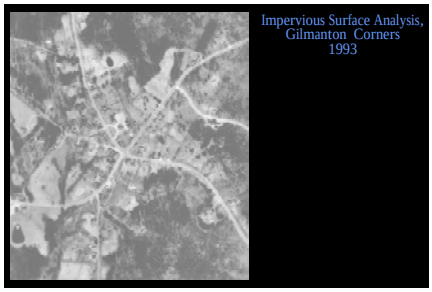
Waterway Health & Imperviousness

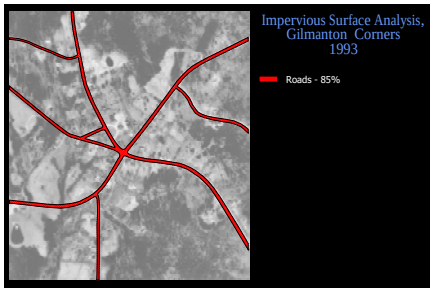


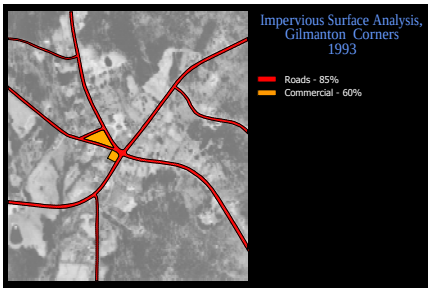
ADAPTED FROM SCHUELER, ET. AL., 1992

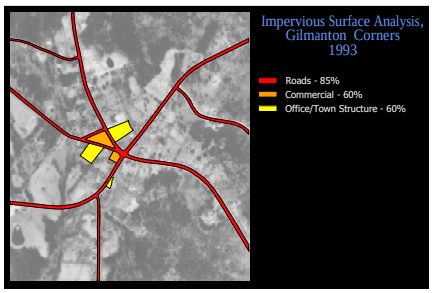
Impervious surfaces

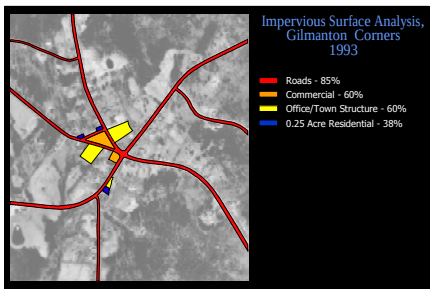
- indicate intensive land uses that cause pollution
- inhibit recharge of groundwater
- prevent natural processing of pollutants in soil, plants
- provide a surface for accumulation of pollutants
- provide an express route for pollutants to waterways

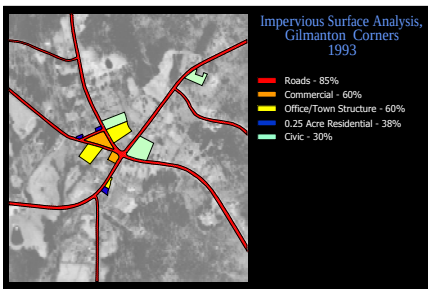

Impervious Surface Analysis,
Gilmanton Corners
1993

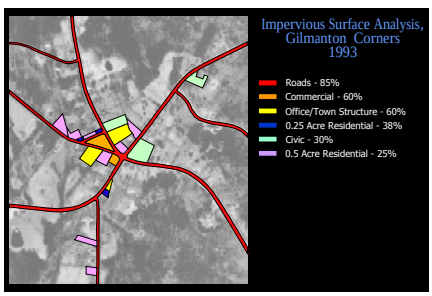

Impervious Surface Analysis,
Gilmanton Corners
1993
Roads - 85%

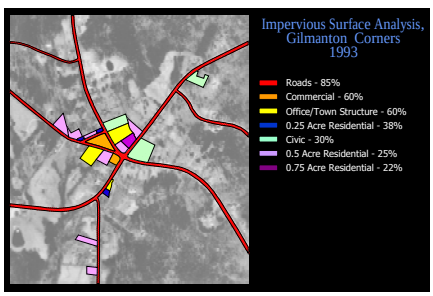

Impervious Surface Analysis,
Gilmanton Corners
1993
Roads - 85%
Commercial - 60%

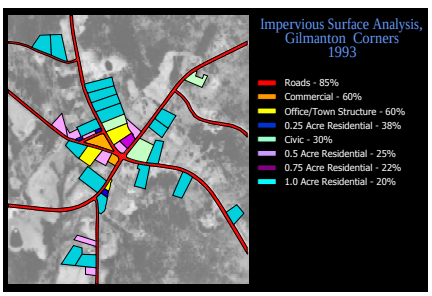

Impervious Surface Analysis,
Gilmanton Corners
1993
Roads - 85%
Commercial - 60%
Office/Town Structure - 60%


Impervious Surface Analysis,
Gilmanton Corners
1993
Roads - 85%
Commercial - 60%
Office/Town Structure - 60%
0.25 Acre Residential - 38%


Impervious Surface Analysis,
Gilmanton Corners
1993
Roads - 85%
Commercial - 60%
Office/Town Structure - 60%
0.25 Acre Residential - 38%
Civic - 30%


Impervious Surface Analysis,
Gilmanton Corners
1993
Roads - 85%
Commercial - 60%
Office/Town Structure - 60%
0.25 Acre Residential - 38%
Civic - 30%
0.5 Acre Residential - 25%


Impervious Surface Analysis,
Gilmanton Corners
1993
Roads - 85%
Commercial - 60%
Office/Town Structure - 60%
0.25 Acre Residential - 38%
Civic - 30%
0.5 Acre Residential - 25%
0.75 Acre Residential - 22%


Impervious Surface Analysis,
Gilmanton Corners
1993
Roads - 85%
Commercial - 60%
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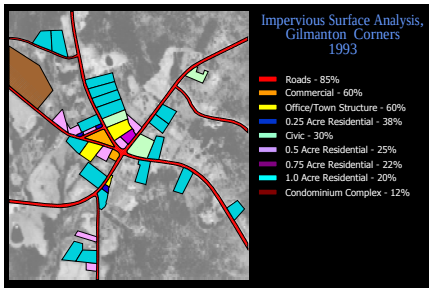
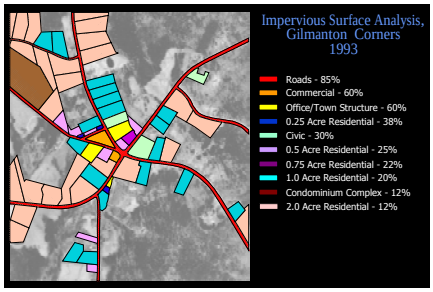
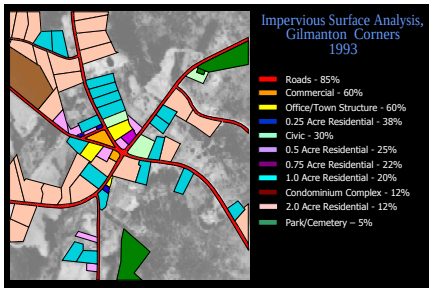
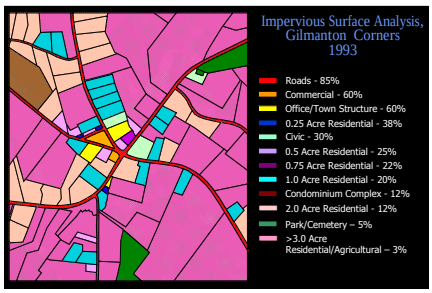
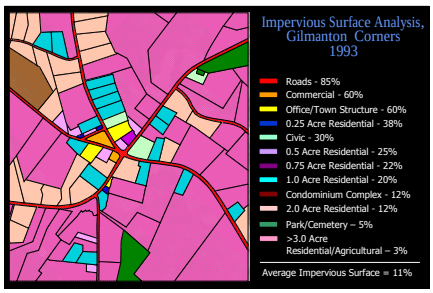
0.25 Acre Residential - 38%
Civic - 30%
0.5 Acre Residential - 25%
0.75 Acre Residential - 22%
1.0 Acre Residential - 20%

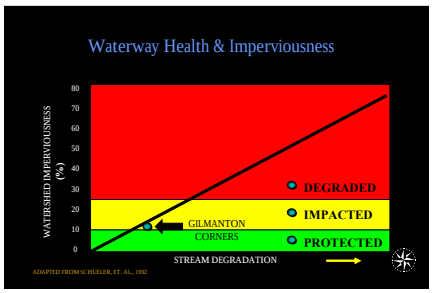




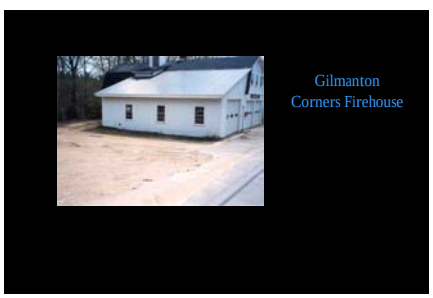








Observations in Gilmanton



Road surface water…

Crystal Lake Dam

channeled directly into the lake.

Catch basins…

drain directly into the Suncook.

Catch basins in parking lot …

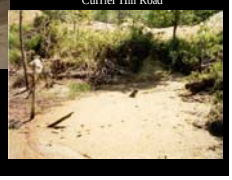
drain into vegetated drainage ditch.

Town Garage Salt Piles

Sawyer Lake Road

Town Garage Contamination and Erosion

Currier Hill Road



Gilmanton Corners Suncook River

So What Are We Supposed to Do?

The Three-tiered Strategy for Coping with Polluted Runoff

1st: Natural Resource Based Planning

2nd: "Green" Site Design

3rd: Structural BMPs & Remediation

Strategy for coping with polluted runoff

- *1st:* Natural Resource Based Planning
  - inventory natural resources
  - open space plan
  - plan of conservation & development
  - watershed plan
  - change regulations

Land Use Plans are blueprints for regulations & policies

Plan of Conservation & Development

The Process...

- Existing development
- Committed open space
- Regulated wetland areas

=Not Available for Development

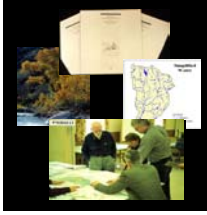
- Areas with limitations

=Net Buildable Area vs. Large Lots

- Areas that are available & suitable for development

=Growth Areas

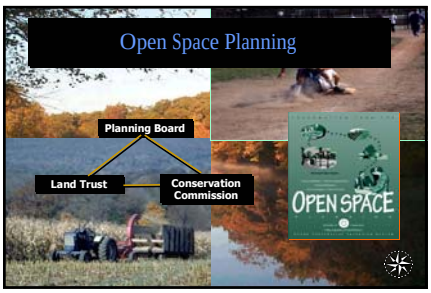
Natural Resource Inventory



The foundation of Planning

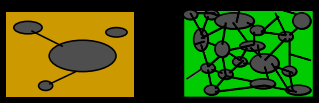
Conservation Commissions are charged with conducting natural resource inventories.

Open Space Planning



The Broad View

Reducing Sprawl Means Concentrating Development in Urban & Village Centers

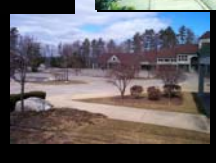


HIGH I.S. IN CENTRAL AREAS....

... BUT OVERALL LOWER I.S. LEVELS THAN WITH SPRAWL

Green is good!

- For stormwater management
- For psychological health
- For aesthetics



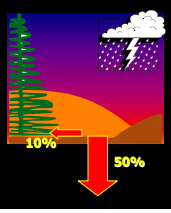
Strategy for coping with polluted runoff

2nd: Site Design

Require stormwater management plans that:

- put development in context of local and regional watersheds
- retain the natural landscape
- reduce impervious surfaces
- emphasize on-site drainage of stormwater
- encourage riparian buffers
- require proper septic system placement, design, and maintenance

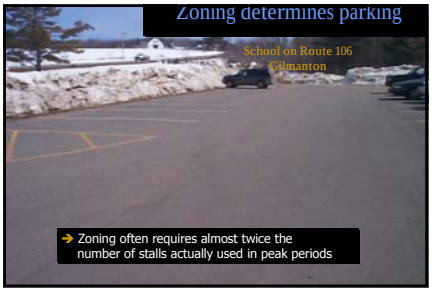
Design Principles



Retain, Restore the Natural Landscape

...by Promoting Infiltration

Zoning determines parking

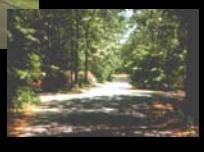


→ Zoning often requires almost twice the number of stalls actually used in peak periods

Alternatives to Pavement

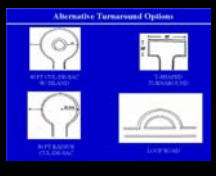
Road Form should follow Function

- wide
- straight
- curbed
- barren



- narrow
- winding
- shaded

Pavement Width varies with function



Engineered Swales

- Promote infiltration
- Most effective at sediment removal
- Open, above-ground systems are easier to maintain & troubleshoot
- Installation costs are favorable compared to piped drainage
- They look better!

Swales on Route 107 above Loon Pond.

Driveways

Are we we overdoing it?

Driveway Tips

- design shorter and narrower drives
- design wide turnaround areas only where needed

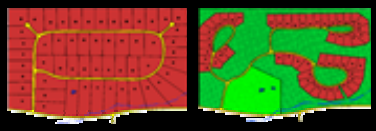
Driveway Tips

- design drives to follow contours & drain to pervious areas
- use pervious alternatives

Sidewalk Tips

- sidewalks only where they make sense
- one side of the street only
- separate sidewalks from road & drainage system by vegetated strips
- consider pervious alternatives

An Alternate Approach: Conservation Developments



- same number of housing units
- 10-50% less impervious surface
- up to 50% open space
- water resources protected

Source: From Randall Arendt

Myths About Conservation Developments:

1. They increase density.
2. They don't protect rural character.
3. They're disguised condo or multifamily units.
4. The open space creates management headaches for the town.

Strategy for coping with polluted runoff

- *3rd:* Structural BMPs & Remediation
  - encourage most natural & vegetated stormwater controls
  - ensure maintenance of roads, lots, catch basins, and BMPs
  - support restoration where effective
  - encourage redevelopment and infilling to avoid further sprawl

Research increasingly shows the benefits of stormwater systems which are:

- OPEN VS. CLOSED
- VEGETATED VS. MECHANICAL
- INFILTRATION VS. RETENTION

Vegetated Buffers

- recognize the importance of riparian and wetland buffers
- buffers are the first line of defense against the impacts of impervious surfaces

Encourage Maintenance of BMPs

- Proper Road Salting and Snow Dumping
- Road Sand Removal
- Septic System Maintenance
- Erosion Control during and after Construction
- Proper Herbicide/Pesticide Application
- Erosion Control during Timber Harvesting Operations
- Stormwater Management in Urban and Semi-Urban Environments
- Road Maintenance

Education is a BMP

Support educational programs

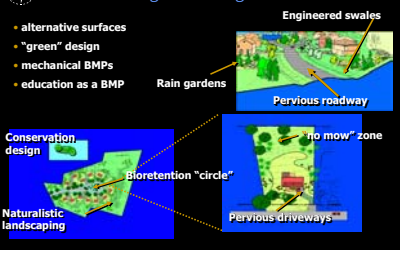
- schools
- residents
- town staff & crews
- town officials

Support special activities

- stormdrain stenciling
- clean-up days
- other resource protection events

Putting it All Together

- alternative surfaces
- "green" design
- mechanical BMPs
- education as a BMP



IT'S UP TO YOU...

IT'S YOUR TOWN!

GILMANTON MASTER PLAN

Land Use (pg. III-1)

"This later trend (expanded use of some seasonal homes) in particular may pose a threat to water quality in some lake areas as the increased use of pre-existing, non conforming houses may extend beyond the design capacity of existing septic systems".

GILMANTON MASTER PLAN

Community Attitudes

1. "Residents want Gilmanton to retain its rural atmosphere and land uses."
2. "More land should be zoned and regulations adopted to allow more businesses and light industry to operate in town."

GILMANTON MASTER PLAN

RECOMMENDATIONS:

6. "Development along existing roads, which preserves more remote land by discouraging new roads, has some advantages for the community."
7. "Special protection from intensive or potentially polluting development needs to be developed."
11. "In cooperation with the Conservation Commission, the Town should map important wetlands and adopt a wetlands protection ordinance to supplement and support the wetlands protection provisions of the subdivision regulations."

GILMANTON ZONING ORDINANCE

Open space Subdivisions

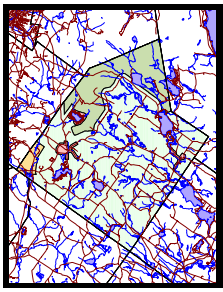
11. To minimize runoff by reducing the land area covered by impervious surfaces.

MASTER PLAN RECOMMENDATIONS

1. Make water quality and the reduction of NPS pollution a GOAL.
2. Revise municipal land use regulations to reflect a commitment to improved water quality.
3. Make water resource education a priority.

Master Plan Implementation

- Lot standards
- Districts
- Parking requirements
- Special exceptions



ZONING

LOT STANDARDS

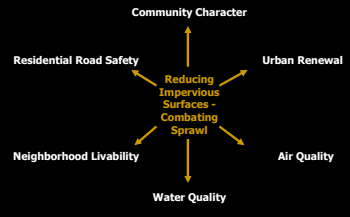
- Coverage (%)
- Setback Requirements
- Buffering Requirements

ZONING

PARKING

- Quantity
- Access
- Buffering
- Stormwater Management

It's Not Just About Water…



Gilmanton Corners,Suncook River

UNIVERSITY OF CONNECTICUT
COOPERATIVE EXTENSION SYSTEM